REMARKS

Applicants have now had an opportunity to carefully consider the Examiner's comments set forth in the Office Action of January 15, 2002. Reexamination and reconsideration are respectfully requested.

The Office Action

Claims 1-26 were presented for examination.

Objections to the specification on the various pages and to the drawings have been made.

Claims 1-17 stand rejected under 35 U.S.C. § 101, as the claims are believed to be directed to an overlap of two different statutory classes of invention.

Claims 1-17 stand rejected based on various informalities.

Claims 1-21 stand rejected under 35 U.S.C. § 112, second paragraph, based on the rejection under Section 101.

Claim 11 stands rejected based on the use of "the sacrificial layer" lacking antecedent basis.

Claims 1-8, 10, 11, 17-22, 25 and 26 stand rejected under the combination of Ogura et al. and Smith et al.

Claims 9, 12 and 13 stand rejected as being unpatentable over the combination of Ogura et al., Smith et al. and further in view of Yamazaki et al.

Claims 14 and 15 stand rejected under the combination of Ogura et al., Smith et al. and further in view of Sekiguchi.

Claim 16 stands rejected on the combination of Ogura et al., Smith et al. and further in view of Yamada et al.

Claims 23 and 24 stand rejected under the combination of Ogura et al., Smith et al. and further in view of Rajeswaran.

The Non-Art Objections and Rejections

With attention to the objections raised to the specification and drawings, Applicants submits appropriate amendments to the specification have been made.

With particular attention to the drawing objection regarding the reference character

"10" being used to designate both a chip and a printbar, Applicants submit they have amended the specification to address this issue. More particularly, it is now more clearly described that the printbar is fashioned in an embodiment as a printbar chip. And in a further embodiment, the printbar chip may be a GaAs printbar chip. It is submitted these changes to the specification do not add any new matter and simply clarify, for the Examiner, the material set forth in the application. In view of the amendment of the specification, it is submitted, further changes to the drawings are not required. If the Examiner requests further clarification, Applicants respectfully request communication from the Examiner be provided to Applicants.

Attention is now directed to the rejection of claims 1 and 17 under 35 U.S.C. § 101. Claims 1 and 17 have been amended by Applicants in an attempt to address the argument the claims embrace or overlap different statutory classes of invention. While specific language was not pointed to by the Examiner, Applicants have made a good-faith effort to address this issue by removing the language "initially fixed to" — which may possibly be interpreted as requiring some method step — with the language "operatively associated with." It is submitted this language addresses the Section 101 rejection.

Turning to paragraph 6 of the Office Action where claims 1 and 17 were objected to based on various informalities, these claims have further been amended to address these issues.

Addressing the rejection of claims 1-21 under 35 U.S.C. § 112, second paragraph, it is submitted the amendments to claims 1 and 17 address those rejections.

Claim 11, has been amended to overcome the stated rejection.

In view of the foregoing, it is respectfully submitted all claims in the application are now in proper form.

The Art Rejections

Independent claims 1, 17, 22 and 26 stand rejected under the combination of Ogura et al. and Smith et al.

With attention to the rejection of claims 17 and 22 (page 7 of the Office Action), it is alleged that Ogura teaches that the substrate and sensor are at least partially transparent to light at the wavelength emitted by at least one of the laser or the LED

device. To support this position, column 16, lines 45-46 of Ogura et al. is cited. It is further proposed that Figures 10A and 28 of Ogura et al. teach that at least a portion of the light emitted by the at least one of the laser and LED device is directed through at least a portion of the substrate and the sensor.

For the following reasons, Applicants traverse this interpretation of Ogura et al.

Initially, and for clarification, as shown in Figure 3 of the present application, the printbar chip 10 including lasers 12 emit a light beam 28 through substrate 32 as well as sensor 34 which are partially transparent. Designing sensor 34 to be transparent at the desired wavelengths allows it to be aligned with a high degree of precision in front of lasers 12, and makes it possible to obtain *in situ* information as to laser output, and provide periodic calibration of the printbar chip 10. Particularly, sensor 34 senses the light beam directly as it exits printbar chip 10. This is possible, again, due to the construction of the sensor and substrate being transparent at desired wavelengths.

This concept is not taught or considered by the cited reference. More particularly, while Figure 10A of Ogura et al. may initially be thought to teach this direct sensing concept (*i.e.*, the light emitted from light source 3 passing through a sensor of photosensor substrate 1), this is not what is occurring in Ogura et al.

The discussion related to Figure 10A is directed to convex portion 2a, which may be fitted into base plate 5. Also shown in this figure is light source 3 and photosensor substrate 1.

Figures 6 and 7 provide a detailed view of the sensor design used in photosensor substrate 1. The design is discussed beginning in column 7, line 14, and it is noted the sensor of photosensor substrate 1 is simply prior art sensor design. The sensor portion is not configured to be at least partially transparent at selected wavelengths. It is also not configured in the overall system to directly sense light emitted from the light source 3. As clearly shown in Figures 6 and 7 and discussed in the specification, light passes through the photosensor substrate (but not the sensor) and illuminates an image holding member (P), then light reflected from the image holding member is received by the photoelectric conversion elements (*see* column 4, lines 5-10). Thus, the sensor of Ogura et al. is designed only to sense reflected light.

This concept is entirely different from the concept taught and described in

independent claims 17 and 22 and claim 26. It is also different from what is claimed in now amended claim 1 and dependent claims 17, 22 and 26.

In claim 17, it is recited that the sensor is at least partially transparent to light at the wavelength emitted by at least one of the laser or the LED device. It is further noted that the light emitted is directed through at least a portion of the substrate and the sensor. This is not taught or fairly suggested by Ogura et al. Claim 22 also recites that this sensor configuration is aligned with a light source such that at least a portion of the light from the light source is sensed by the sensor. Independent claim 1 has been amended to clarify these matters. Lastly, claim 26 sets forth the hybrid device aligned with a light source at least partially through the sensor.

Dependent claims 2-5 further define the transparent nature of the sensor and the alignment of the sensor with the light-emitting elements such that light is emitted at least partially through a portion of the sensor.

Again, turning to column 7, the description of the sensor clearly shows that it is not transparent. For example, the sensor includes a light-shielding layer 201. Therefore, rather than teaching the transparent features of the claimed invention, this language specifically teaches away from a transparent type of sensor. Emitting the light directly through the sensor permits the present system to work with printing systems having closely packed emitters. On the other hand, Ogura et al.'s use of reflected light does not permit such use.

For the foregoing reasons, it is respectfully submitted independent claims 1, 17, 22, and 26 are distinguished. As rejection of the corresponding dependent claims to these independent claims incorporate the combination of Ogura et al. and Smith et al., it is submitted these dependent claims are also distinguished.

Turning to the rejection of claim 23, it is stated in the Office Action that the language in lines 13-24 are merely "result or function" language which are not being relied upon to define over Ogura et al. in view of Rajeswaran. The language has been amended to address the Examiner's concerns.

It is submitted the language as now presented provides elements not taught or fairly suggested by the cited reference. More particularly, Applicants described calibration system is unique from existing techniques and devices. It is submitted the combination

of Ogura et al., Smith et al. and Rajeswaran does not provide the now defined activation signal, driver, high frequency shift register and enable/disable output signal.

For this reason, it is respectfully submitted dependent claim 24 is not taught or fairly suggested.

A new independent claim 27 and corresponding dependent claim 28 is made by this amendment. New claim 27 provides a method related to independent claim 22 and dependent claim 23, which define the operation of the calibration system not taught or fairly suggested by the cited art. New dependent claim 28 clarifies that the calibration process takes place without needing to move the printbar out of the printing area or, in other words, occurs *in situ*.

CONCLUSION

For the reasons detailed above, it is respectfully submitted all claims 1-28 are now in condition for allowance. An early notice to that effect is therefore earnestly solicited.

Respectfully submitted,

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Attachment: Version with Markings to Show Changes Made

CERTIFICATE OF MAILING

I hereby certify that this Amendment B is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner of Patents and Trademarks, Washington, D.C. 20231, on **March 18, 2002**.

By Karen M. Forsyth

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification

Please amend the pending paragraph on page 2, lines 13-22, as follows:

______Due to their narrow beam profile and high efficiency, photolithographically configured laser printbars have been found to provide certain advantages. Proposed laser printbars consist of an array of Vertical-Cavity Surface-Emitting Lasers (VCSELs) which may be designed with as small as 3 μm pitch. At such a pitch, a 4cm-long laser chip would accommodate more than 13,300 individually addressable laser elements, more than necessary for 1,200dpi printing on a standard [11inch-long] 11-inch-long paper, where 13,200 elements are required. A drawback of such a large number or light sources, ultra-high density-packed, is the expectation of non-uniformity of laser responses. This non-uniformity has the potential for high spatial frequency that makes the effect on printed images noticeable to the human eye.

Please amend the pending paragraph on page 5, lines 5-6, as follows:

Turning to FIGURE 1, illustrated is a section of a laser printbar chip (also called in the following simply a printbar) **10** having individual lasers **12** interleaved at a 3 μm pitch spacing.

Please amend the pending paragraph on page 14, lines 18-23, as follows:

Turning to the calibration process, it is noted that in a first embodiment, calibration of lasers **12** of printbar **10** is accomplished by sensing and calibrating a single laser at a time. Particularly, sensors (**34, 34', 53, [68]** 67, **74**) are sufficiently sized to be placed in front of all lasers **12** of printbar **10**. In one calibration scheme, the imaging device is not being used to print an image during calibration. Rather, the calibration process takes place during a time when image processing is not occurring.

Please amend the pending paragraph on page 14, lines 24-28, as follows:

In the embodiment describing the laser printbar, it is assumed sensors **53, [68, 70]** 67, 74 are rectangular sensors of approximately 4cm by 200 micrometers, which is large enough to intercept 100% of the laser beams diverging from printbar **10**, for a substantially 4cm-long laser array. The typical divergence of the VCSEL's beam was noted to be smaller than 20°.

Please amend the pending paragraph on page 14, lines 29-32, as follows:

The transparency of the amorphous silicon film ensures sufficient laser radiation to exit from the sensor to allow for printing while low (10pA/cm^2) dark leakage current of sensors **53, [68, 70]** 67, 74 maintains the contrast ratio (or light-to-dark ratio) at a high enough value for operation.

Please amend the pending paragraph on page 16, lines 8-11, as follows:

Turning attention to FIGURE 14, a block diagram of a calibration/printing system **110**, according to the present invention is depicted. Driver chip **24** (which could also be driver chip **26**) is shown in association with printbar **10** and sensor **34**, (sensors **34', 53, [68, 70]** 67,74 or other appropriately formed sensor may also be used).

Please amend the pending paragraph on page 20, lines 26-32, as follows:

In a further embodiment, sensors **34, 34', 53, [68, 70]** 67, 74 may be constructed as a plurality of sensors, into a sensor array. In this manner, instead of testing a single laser at a time, multiple lasers of multiple arrays may be tested in parallel. A drawback of using smaller sized arrays as opposed to a single sensor is that the sensor medium may age at different rates for different arrays used. An advantage is that the speed of the calibration process is increased by parallel operation and makes easier to push the calibration procedure toward real-time.

In the Claims

Please cancel claims 7 and 10.

Please amend pending claim 1 as follows:

1. (Twice Amended) A hybrid device comprising:

a substrate;

a micro-spring interconnect formed on the substrate, the micro-spring interconnect including,

an elastic material that is [initially fixed to] operatively associated with a surface [on] of the substrate including,

an anchor portion fixed to the substrate, and

a free portion spaced from the substrate; and

a sensor formed on the substrate, the sensor including an active layer and contacts, said active layer [sensing] configured to sense light and at least partially transparent to light at selected wavelengths,

said micro-spring interconnect and said sensor being integrated on the substrate.

Please amend pending claim 2 as follows:

2. (Amended) The invention according to claim 1 wherein the hybrid device further includes at least one of a single light source, an array of lasers, and an array of light emitting diodes (LEDs), positioned to emit at least a portion of light [at least partially] through at least a portion of the sensor.

Please amend pending claim 3 as follows:

3. (Amended) The invention according to claim 2 wherein the sensor is designed and aligned with at least one of the laser array and the LED array, to receive the emitted light from at least one of, some of the lasers of the laser array and some of the LEDs of the LED array.

Please amend pending claim 4 as follows:

4. (Amended) The invention according to claim 2 wherein the sensor is designed and aligned with at least one of the laser array and the LED array to receive and pass substantially all of the emitted light from a portion of at least one of the laser array and the LED array.

Please amend pending claim 5 as follows:

5. (Amended) The invention according to claim 4 wherein the substrate is designed and aligned with at least one of the laser array and the LED array to receive and pass substantially all the emitted light from a portion of at least one of the laser array and the LED array.

6. The invention according to claim 1 wherein the sensor is an array of sensors.

8. The invention according to claim 1 wherein the sensor and the micro-spring interconnect are comprised of materials which allow for integration of the micro-spring interconnect and the sensor on the single substrate during a manufacturing process, wherein at least one of the materials for the micro-spring interconnect and the sensor is the same.

9. The invention according to claim 1 wherein the sensor is comprised of,

a first transparent/conductive layer;

an active layer on top of the first transparent/conductive layer;

a second transparent/conductive layer on top of the active layer;

a passivation/release layer located over at least the first transparent/conductive layer and the second transparent/conductive layer;

vias through the passivation/release layer to the first and second transparent/conductive layers; and

a metal layer connecting to the first and second transparent/conductive layers through the vias, wherein the metal layer acts as signal lines to receive and carry

signals from the active layer.

Please amend pending claim 11 as follows:

11. (Twice Amended) The invention according to claim 10 wherein the elastic material is a stressed metal layer having sub-layers of differing stress gradients[, wherein when the sacrificial layer is released from the passivation/release layer, the released portion moves out of a plane of the substrate].

12. The invention according to claim 1 wherein the sensor further includes an absorption layer, located immediately over the sensor, wherein the absorption layer absorbs unwanted light prior to being detected by the active layer.

13. (Amended) The invention according to claim 9, wherein the active layer is a three layer element, wherein a first layer is a n+-doped amorphous silicon, the first layer being one of, but not limited to n+ phosphorous–doped amorphous silicon and n+ arsenic-doped silicon;

wherein a second layer is an intrinsic amorphous silicon;

wherein a third layer is a p+-doped amorphous silicon, the third layer being, but not limited to, p+ boron-doped amorphous silicon.

14. The invention according to claim 1 wherein a switch is located, between the sensor and the substrate, such that the sensor is an active semi-continuous sensor.

15. The invention according to claim 14 wherein the switch is a thin-film-transistor (TFT).

16. The invention according to claim 1 wherein the micro-spring interconnect is a plurality of micro-spring interconnects.

Please amend pending claim 17 as follows:

17. (Amended) A hybrid device comprising:

at least one of a laser or LED device capable of emitting light at a certain wavelength;

a substrate;

a micro-spring interconnect formed on the substrate, the micro-spring interconnect including,

an elastic material [that is initially fixed to] <u>operatively associated with a surface of</u> the substrate <u>including</u>,

an anchor portion fixed to the substrate, and

a free portion <u>spaced from the substrate</u>; and

a sensor formed on the substrate, in an integrated manner, with the micro-spring interconnect, the sensor including an active layer and contacts, wherein said substrate, and said sensor are at least partially transparent to light at the wavelength emitted by at least one of the laser or the LED device; and

said at least one of the laser or the LED device and said substrate with said sensor and said at least one micro-spring interconnect being separately fabricated and aligned, such that at least a portion of the light emitted by the at least one of the laser and LED device is directed through at least a portion of the substrate and the sensor.

18. The invention according to claim 17, wherein at least a portion of the laser or the LED device is a plurality of lasers or LEDs formed in a laser or LED array.

19. The invention according to claim 17 wherein the sensor is sized such that each of the lasers or LEDs emit light at least partially through the sensor.

Please amend pending claim 20 as follows:

20. (Amended) The invention according to claim 17 wherein the sensor is a plurality of sensors, sized such that a sub-group of the lasers or the LEDs may emit light through selected ones of the [of] sensors.

21. The invention according to claim 19 wherein the lasers or LEDs are arranged as a printbar, and the micro-spring interconnect is in electrical contact with the

printbar.

Please amend pending claim 22 as follows:

22. (Twice Amended) A calibration/printing system comprising:

a sensor configuration including a sensor element integrated on a substrate with a plurality of micro-spring interconnects;

a light source aligned with the sensor configuration such that at least a portion of the light from the light source is sensed by the sensor and at least a first of the micro-spring interconnects is in physical contact with a portion of the light source; and

a driver chip aligned with the sensor configuration and the light source such that at least a second of the micro-spring interconnects is in physical contact with a portion of the driver chip, and a communication path is formed between the light source and the driver chip by the at least first and second micro-spring interconnects.

Please amend pending claim 23 as follows:

23. (Twice Amended) The invention according to claim 22 wherein the driver chip further includes:

a comparator for comparing a sensor readout current from the sensor and a reference current;

a converter arrangement which converts the output of the comparator into digital data representing characteristics of the light source;

a set of low frequency shift registers configured to receive and store the digital data;

an activation signal selectively supplied to the light source, the activation signal designed to control operation of the light source to selectively emit light therefrom;

a driver designed to interpret the digital data as activation signal correction information for the activation signal;

a high frequency shift-register configured to receive and store digital image data from a source external to the driver chip; and

an enable/disable output signal from the high frequency shift-register to selectively supply the activation signal and light source correction information to the light

source, wherein an amount of light emitted by the light source is controlled.

24. The invention according to claim 22 wherein the digital image data from the source external to the driver chip is supplied as high frequency bit stream data.

25. The invention according to claim 22 wherein the light source is a printbar having an array of light sources, and wherein the printbar is controlled to activate the light sources in a sequential manner to obtain calibration data to be stored in the driver.

26. (Amended) A hybrid device comprising:

a micro-spring interconnect structure; and

at least two devices electrically connected by the interconnect structure wherein,

one of the devices is a sensor, the sensor including an active layer and contacts, said active layer sensing light, and

another one of the devices is at least one of a single light source, an array of lasers, and an array of light emitting diodes (LEDs), positioned to emit light at least partially through the sensor.

Please add new claims 27 and 28 as follows:

27. (New) A method of calibrating a printing system comprising:

aligning a sensor configuration such that at least a portion of light from a light source is sensed by the sensor configuration;

comparing, by a converter, a sensor readout current and a reference current;

converting an output of the comparator into digital data representing characteristics of the light source;

storing the digital data in a set of low frequency shift registers;

interpreting, by a driver, the digital data as light source correction information for use by activation signal wherein the actuation signal controls activation of the light source;

storing digital image data from a source external to the driver chip in a high frequency shift-register; and

generating an enable/disable output signal from the high frequency shift-register to selectively control a supplying of the activation signal and light source correction information to the light source, wherein an amount of light emitted by the light source is controlled.

28. (New) The method according to claim 27 wherein calibration of the printing system occurs *in situ*.